

Appl. No. 10/820,856
Amendment dated: August 11, 2006
Reply to OA of: May 11, 2006

REMARKS

This is in response to the Official Action of May 11, 2006 in connection with the above-identified application. Applicants have amended the specification and claims as described below.

With respect to the specification, Applicants note that paragraphs [0021] and [0022] have been amended to correct an obvious typographical error. Specifically, the paragraphs have been amended to clarify that the invention aims to prevent the formation of the discontinuous block at the interface between the first barrier layer 206b and the wetting layer 206c. Support for the amendments to paragraphs [0021] and [0022] may be found in the originally filed specification at, e.g., paragraph [0009] ("It should be noted that the second barrier layer can slow down the formation of the inter-metallic compound in the interface between the first barrier layer and the wetting layer..."). Accordingly, Applicants respectfully submit that no new matter is introduced into the application by the amendments to the specification presented herein.

With respect to the claims, Applicants have canceled claims 8-19 as being directed to the non-elected invention. These claims are canceled without prejudice or disclaimer and all rights to file a divisional application directed to the canceled subject matter are reserved.

The rejection of claims 1 and 2 under 35 U.S.C. §102(b) as being anticipated by Mis et al. (US Pat. No. 5,767,010) has been carefully considered but is most respectfully traversed in light of the following comments

Applicants wish to direct the Examiner's attention to MPEP § 2131 which states that to anticipate a claim, the reference must teach every element of the claim.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed Cir. 1989). The elements must be arranged as required by the

Appl. No. 10/820,856
Amendment dated: August 11, 2006
Reply to OA of: May 11, 2006

claim, but this is not an *ipsissimis verbis* test, i.e., identity of terminology is not required. *In re Bond*, 910 F.2d 831, 15 USPQ2d 1566 (Fed.Cir. 1990).

The Official Action urges that Mis discloses an under bump metallization structure as claimed in the instant application, including an adhesive layer 28 formed on bonding pads 24, a first barrier layer 30 disposed on the adhesive layer 28, a wetting layer 32 formed on the first barrier layer 30 and a second barrier layer 34' disposed on the wetting layer. Applicants specifically traverse this statement.

Firstly, Applicants note that in the present application, a multi-layer under bump metallization (UBM) layer is claimed, wherein the layers of the UBM comprise an adhesive layer, a first barrier layer, a wetting layer and a second barrier layer. That is to say, each layer recited is a part of the UBM layer. To the contrary, Mis discloses a titanium barrier layer 28, with a under bump metallurgy layer formed thereon (see, e.g., col. 4, lines 11 and 12). Thus, rather than disclose a layer 28 that is part of the under bump metallization layer, Mis actually discloses a UBM layer that is separate from the titanium barrier layer 28. Accordingly, it is incorrect for the Official Action to assert that Mis discloses a UBM layer wherein the titanium barrier layer is part of the UBM layer structure.

The fact that the titanium barrier layer is separate from the UBM layer in Mis may be seen by examining, e.g., col. 4, lines 12-22. This portion of the reference first notes that "[t]he under bump metallurgy layer is formed from materials... which can be selectively etched from away from the titanium barrier layer 28 without significantly etching the titanium barrier layer." This clearly indicates that the titanium barrier layer is not part of the UBM layer. The reference continues that "the under bump metallurgy layer preferably comprises a chromium layer 30... a phased layer 32 of chromium and copper... and a copper layer 34." There is no mention of the titanium barrier layer 28 being included in the UBM layer, and therefore it cannot properly be considered a layer of the UBM layer.

Accordingly, since Mis clearly states that layer 28 is not part of the UBM layer

Appl. No. 10/820,856
Amendment dated: August 11, 2006
Reply to OA of: May 11, 2006

disclosed therein, Applicants respectfully submit that, as an initial matter, the Official Action has failed to establish a proper §102(b) rejection according to the guidelines set forth in MPEP §2131. Applicants therefore respectfully request that this rejection be withdrawn.

Secondly, Applicants note that Mis refers to the layer 28 as a titanium barrier layer, and not an adhesion layer as claimed in the instant application. Despite this clear indication in Mis that titanium layer 28 is a barrier layer, the Official Action mis-categorizes the layer as an adhesion layer in order to support the §102(b) rejection. But such an interpretation is clearly improper where the function of the adhesion layer as claimed in the instant application and the function of the barrier as disclosed in Mis are different. The present application discloses that the adhesion layer formed on the bonding pads is for enhancing the mechanical strength of the connection between the bonding pads and the barrier layer. Mis discloses that the barrier layer 28 is for preventing the UBM layer from forming residues on the microelectronic device, which could result in electrical shorts between solder bumps and protects the underlying microelectronic device from the etchants used to remove the UBM layer (see, e.g., col. 6, lines 33-41). It cannot be ignored that Mis discloses layer 28 as a barrier layer and discloses that it is made of titanium, a material that is used for barrier layers. Similarly, it cannot be ignored that Mis does not disclose that layer 28 may be an adhesive layer and that titanium is not commonly known in the art as being capable of serving as an adhesive layer. Thus, Applicants respectfully submit that, contrary to the position taken in the Official Action, Mis fails to disclose an adhesion layer as recited in the instant claims.

In light of the above discussion, Applicants respectfully submit that Mis fails to disclose each and every element of the claimed invention and therefore cannot properly support a §102(b) rejection according to the guidelines set forth in MPEP §2131. Applicants therefore request that this rejection be withdrawn.

Finally, with respect to the second barrier layer recited in the claims of the instant application, the Official Action urges that Mis discloses disposing a second barrier layer

34' comprising tin and copper on the wetting layer 32. However, Applicants note that a careful reading of Mis reveals that a barrier layer comprising tin and copper is not disposed on the wetting layer, but rather a copper layer 34 is disposed on the phased layer 32. The reflowed solder material 42 forms an intermetallic region 34' with the copper layer 34 and the intermetallic region 34' may include tin and copper. However, this layer is clearly not disposed as a tin and copper layer on the wetting layer, but rather the layer is only formed from the interaction between the solder material and the top layer of the UBM layer. Thus, while the claims of the instant application recite disposing a second barrier layer comprising tin and copper before reflow process, Mis merely discloses disposing a copper layer as a top layer of the UBM layer and then forming a tin and copper layer through a reaction between the reflowed solder material and the top layer of the UBM layer. No portion of Mis discloses disposing a second barrier layer comprising tin and copper as claimed in the instant application.

Further, the second barrier layer can slow down the formation of the inter-metallic compound in the interface between the first barrier layer and the wetting layer due to the material of the second barrier layer mainly comprising tin and copper wherein the quantity of copper is larger than that of tin so as to prevent discontinuous blocks, i.e. Ni_3Sn_4 , from being formed in the first barrier of the under bump metallization structure (Please see paragraph [0009], lines 7-14). Particularly, the inter-metallic compound between the solder and the under metallization structure is non-avoidable, the second barrier layer of invention can slow down the formation of the inter-metallic compound to enhance the reliability of the solder bump.

In light of the above discussion, Applicants respectfully submit that Mis fails to disclose each and every element of the claimed invention and is therefore incapable of properly supporting a §102(b) rejection according to the guidelines set forth in MPEP §2131. Accordingly, Applicants respectfully request that this rejection be withdrawn.

The rejection of claims 3-5 under 35 U.S.C. §103(a) as being unpatentable over Mis in view of Chen et al. (US Pat. No. 6,819,002), the rejection of claim 6 under 35 U.S.C. §103(a) as being unpatentable over Mis in view of Chen et al. (US Pub. App. No.

Appl. No. 10/820,856
Amendment dated: August 11, 2006
Reply to OA of: May 11, 2006

2003/0104683) and the rejection of claim 7 under 35 U.S.C. §103(a) as being unpatentable over Mis in view of Chen ('002 patent) have each been carefully considered but are most respectfully traversed in light of the following comments.

Applicants wish to direct the Examiner's attention to the basic requirements of a prima facie case of obviousness as set forth in the MPEP § 2143. This section states that to establish a prima facie case of obviousness, three basic criteria first must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Section 2143.03 states that all claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

Applicants also note MPEP §2143.01, which states in part that, if a proposed modification would render the prior art invention unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

Applicants also most respectfully direct the Examiner's attention to MPEP § 2144.08 (page 2100-114) wherein it is stated that Office personnel should consider all rebuttal argument and evidence presented by applicant and the citation of *In re Soni* for error in not considering evidence presented in the specification.

All of the above recited rejections use as their basis the rejection of claim 1 as

Appl. No. 10/820,856
Amendment dated: August 11, 2006
Reply to OA of: May 11, 2006

being anticipated by Mis. However, as discussed in detail above, the rejection of claim 1 as being anticipated by Mis is erroneous because Mis fails to disclose several elements recited in claim 1. Accordingly, the deficiencies identified above with respect to the §102(b) rejection over Mis apply equally to the §103(a) rejections of the claims that rely upon Mis as the primary reference.

Furthermore, Applicants respectfully submit that neither of the secondary references cited in the §103(a) rejections are capable of remedying the deficiencies identified above with respect to the Mis reference. The Chen patent is relied upon as disclosing different materials that may be used for the layers of UBM layer. The Chen published application is also relied upon as disclosing different materials that may be used for the layers of the UBM. Neither reference disclose or suggest those elements of the claimed invention which are not disclosed in Mis as discussed in detail. Accordingly, since neither Mis, the Chen patent nor the Chen published application, either standing alone or when taken in combination, disclose or suggest every element of the claimed invention, Applicants respectfully submit that a proper §103(a) rejection according to the guidelines set forth in MPEP §2143 has not been established. These rejections should therefore be withdrawn.

Further, with specific respect to claim 6, Applicants note that the Chen published application does not disclose that a wetting layer may be titanium as asserted in the Official Action. A careful review of paragraph [0007] of the Chen application reveals that adhesive layer and the barrier layer may be titanium, but does not disclose that the wetting layer may be titanium. The relevant portion of paragraph [0007] reads “[t]he wetting layer 23, which is usually composed of copper, can be bonded to the solder bumps”. Therefore, it is clear that Chen does not disclose a wetting layer comprising titanium as alleged in the Official Action. Accordingly, Applicants respectfully request that this rejection be withdrawn.

Appl. No. 10/820,856
Amendment dated: August 11, 2006
Reply to OA of: May 11, 2006

In view of the above comments and further amendments to the claims, favorable reconsideration and allowance of all of the claims now present in the application are most respectfully requested.

Respectfully submitted,

BACON & THOMAS, PLLC

By: 
Scott A. Brairton
Registration No. 55,020

625 Slaters Lane, 4th Fl.
Alexandria, Virginia 22314
Phone: (703) 683-0500
Facsimile: (703) 683-1080

SAB
A01.wpd

August 11, 2006